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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

This Issue

Lubrication of the Modern Textile Mill

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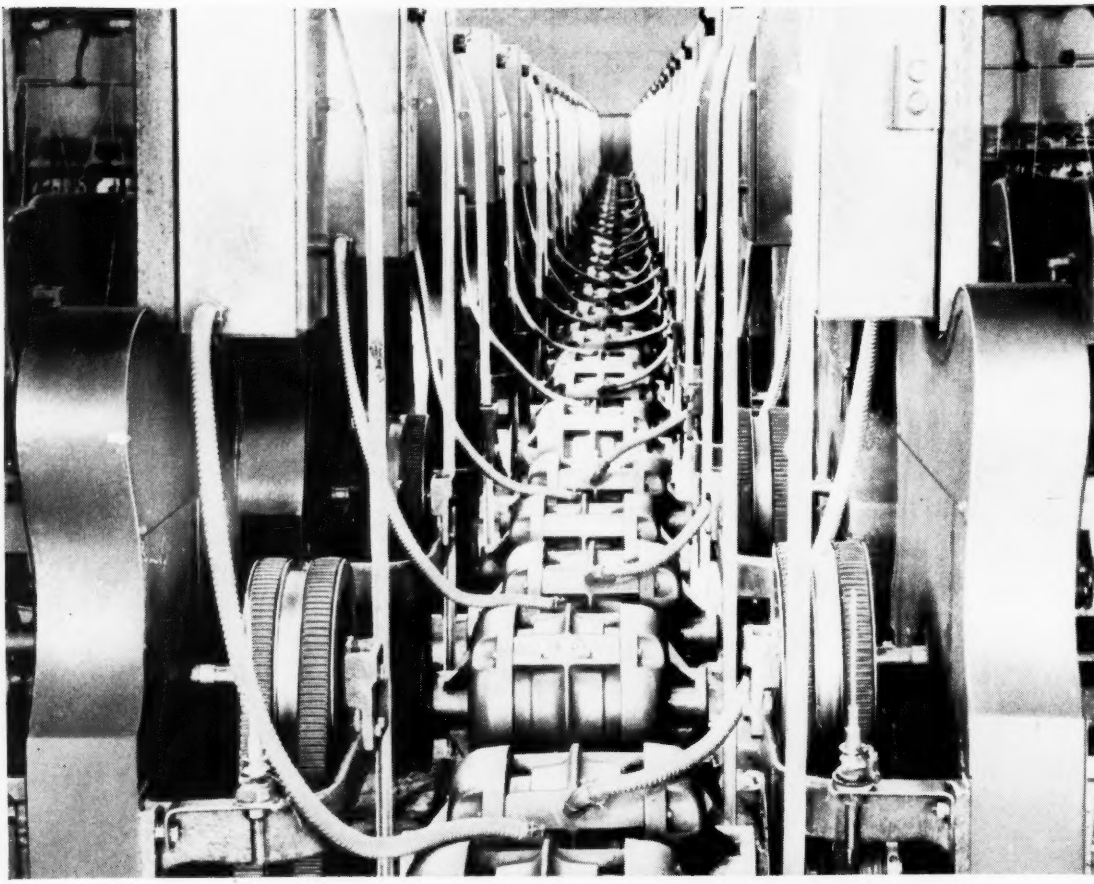

LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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Lubrication of the Modern Textile Mill

This article is devoted to highlighting the important lubrication needs of the modern textile mill. It outlines how such needs are met by the selection and proper application of suitable lubricants. It points out that the success of such a program requires that mill managements have a full understanding and appreciation of the benefits which will accrue from such a program and that lubrication personnel are properly trained and supervised. Significant trends, developments, and lubrication problems in modern textile mills are also discussed. Suggestions are given on important steps which will insure maximum benefits from a lubrication program.

IN THE United States the annual production of textiles of all types is nearly 40 pounds per person or a total of over six billion pounds of fibers processed per year. While the industrial potential of the textile industry had its origin approximately 200 years ago in the original inventions of various carding, spinning and weaving machines, the present vigor of the industry depends on a number of continuing factors. Important among these are further improvements in the older type mechanisms used in textile machinery and in the invention of new equipment designed to increase textile production rates.

In addition, new developments in the textile industry of which we have heard a lot in recent years include new fibers and new types of fabrics made from all types of fibers. In this regard according to the U. S. Department of Agriculture the domestic mill consumption of man made fibers was 11.2 lbs. per person in 1955. The development of textiles has included improved finishing operations which impart the proper sheen, appearance, feel and draping to the finished materials, particularly for dress goods. These tangible machinery and product developments are backed up by intelligent, trained mill managements who strive for lower costs of production, improved textile quality and increased production rates.

Petroleum products for both the lubrication of textile machinery and the processing of textile fibers have furnished powerful tools for textile mill managements in attaining these objectives. Such products have been specially developed for their intended purposes by the lubricant suppliers through research and through the closest cooperation with the manufacturers of textile mill machinery and with their mutual customers, the textile mill operators. As new lubricant needs have arisen due to the development of new machinery components, new products have been developed to meet these needs.

TRENDS IN THE TEXTILE INDUSTRY

In line with the efforts made to obtain increased production at reduced costs, the textile industry has moved forward on a number of fronts. For example, speeds have been increased on textile machinery

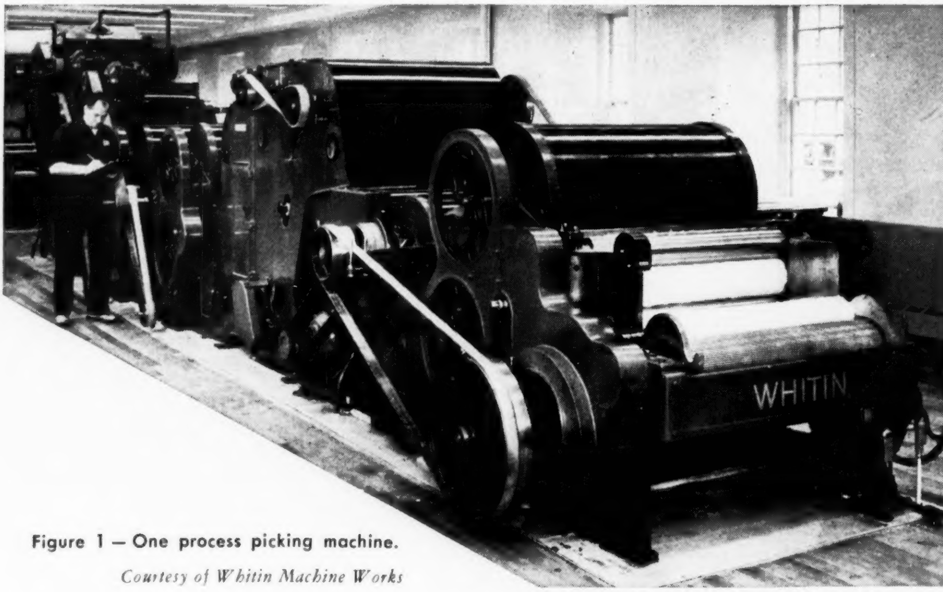
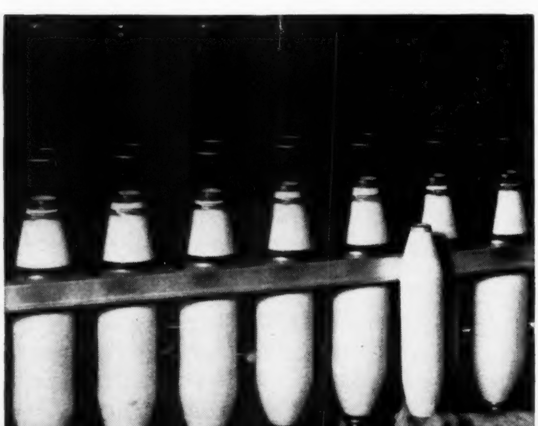


Figure 1 — One process picking machine.

Courtesy of Whitin Machine Works

such as spindles and looms to increase production. Package sizes for handling the fibers, yarn and fabrics have been increased to reduce labor and to reduce periods of machinery down-time. An example of increased package size is given in Figure 2. Also, longer draft spinning of thread has been developed and is used to increase production by eliminating intermediate processing steps previously used.

Other improvements have included the use of porous bearings (which retain lubricant and reduce lubrication requirements), anti-friction bearings (which require less frequent attention and reduce power and maintenance), improved seals and bearing designs (to reduce lubricant leakage), special bearing materials (which reduce wear), and improved metals and precision finishes which improve the quality of finished work by providing smoother operation with less vibration.



Courtesy of Saco-Lowell Shops

Figure 2 — Example of increased package size in the textile industry.

Additional developments have included the wider use of grease and multi-purpose lubricants to simplify lubricant application. The use of ball and roller bearings with grease lubrication is of particular interest since bearings are sealed, which increases time between necessary relubrication periods and also reduces the possibility of lubricant leakage and hence staining which may lead to material spoilage. Many mills have considered it desirable to install anti-friction bearings on older equipment to obtain the benefits from such type of bearings. Roller bearings (see Figure 3) have been particularly useful on rolls and saddles of spinning frames to reduce the frequency of lubrication required by the plain bearing types. As seals and improved designs have been incorporated into the design of textile machinery, interest in premium type, high quality lubricants has increased. Now, lubricants are expected to last longer without being replenished and to protect more expensive, high precision rubbing parts.

Besides improvements to make application of lubricants simpler, centralized lubrication systems have been introduced to reduce labor costs and to obtain other benefits which include more even lubrication with less possibility of contamination.

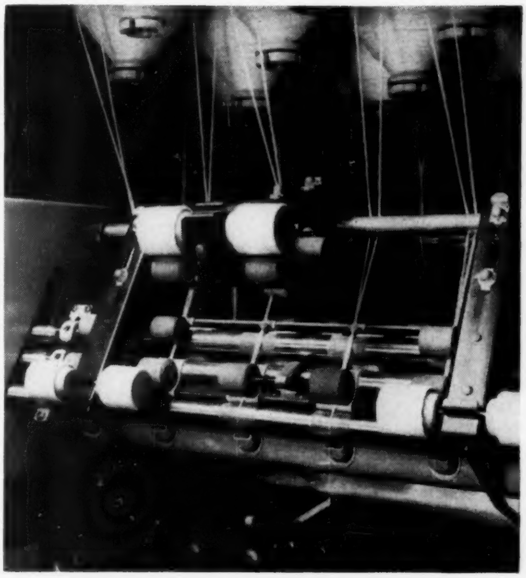
Another trend which emphasizes the importance of lubrication is the increased use in some mills of centralized control of the lubrication program, as contrasted to separate control by the overseer of

each department. Such central control has been organized either as a branch of the Master Mechanic or Chief Engineer's work, or a separate Lubrication Engineer has been placed in charge.

The modern trend in spindles is toward increased use of anti-friction bearing spindles or plain bearings of improved materials with closer tolerances for the desired high speed operation.

Wider use of air conditioning in the mills and of fiber processing aids has also improved the manufacturing operations. In this connection processing oils are used for various purposes, including the reduction of fly and lint, and anti-static oils are widely used to facilitate textile processing and to improve the quality of the finished materials.

Obviously all these developments have contributed to increased efficiency of textile mills, increased production and reduced operating costs.



Courtesy of Saco-Lowell Shops

Figure 3 — Anti-friction bearings in spinning frame top rolls.

APPRECIATION OF THE IMPORTANCE OF GOOD LUBRICATION

The textile industry is unique among industries in having such a tremendous number of moving parts in its equipment. For example, a small modern loom has over 150 lubrication points and many spinning frames and full-fashioned hosiery machines have over 1000 points per machine to be lubricated. When it is realized that some textile mills have as many as 9,000 looms and 3,000 spinning frames, the magnitude of the lubrication problem is apparent. As modern textile machinery has been developed to have more and more precision parts, the importance of good lubrication to protect such parts and insure their proper operation has also become of constantly increasing importance. Figure 4 gives some idea of the numerous moving parts on such machinery.

These parts are subject to wear unless furnished with suitable lubricants which are applied at proper

Courtesy of Textile Machine Works

Figure 4 — Full-fashioned knitting machines estimated to contain 188,000 individual parts.

WHAT MANAGEMENT CAN EXPECT FROM A GOOD LUBRICATION PROGRAM

Results of Good Lubrication Program	Benefits to Textile Plant
1. Protect machinery and lengthen its life.	Reduce capital expenditure, cost of parts and maintenance.
2. Improve and maintain the operation of machinery for the production of high quality textiles.	Insure top financial return from sale of plant output at highest quality level.
3. Protect material against spoilage from staining or from equipment malperformance.	Increased production from maintaining spoilage to a minimum. (Rejected material cuts production just as much as reduced speed or shut-down. It is actually worse from a cost-of-production standpoint, moreover, for it also wastes raw materials.)
4. Less consumption of lubricants and power. Reduced down-time for maintenance and less labor required for lubricant application.	Reduction in costs of operation including that of power, of lubricants, of labor and of shut-downs.
5. Minimize possibility of hot running bearings due to lack of lubrication.	Reduction in fire hazard.
6. Provide uninterrupted operation.	Increased production and *profits*.

intervals in correct amounts. The various lubrication needs of these points create a considerable problem. To handle such a problem requires that a carefully planned lubricating program be carried out. There can be no firm and continuing basis for such a lubricating program, however, unless those in the textile mill management who are concerned with the conception and execution of the program have a full appreciation of the benefits which will accrue therefrom. For example, the results and benefits in a textile mill of such a program, which might be more aptly entitled "A Wear Prevention Program," are outlined briefly in the chart above.

TEXTILE LUBRICANTS

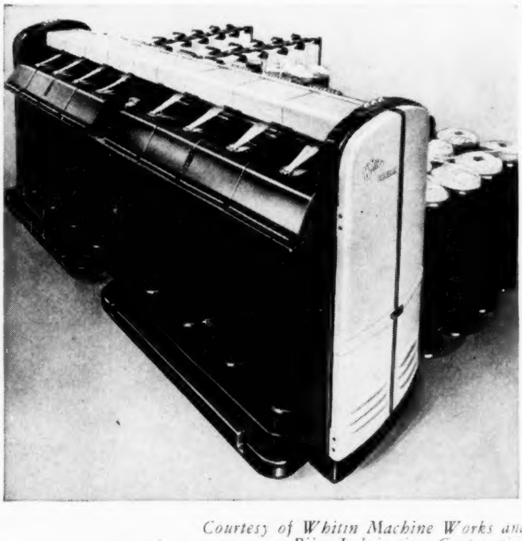
A good lubrication program depends upon the availability and selection of suitable lubricants designed to do the specific job for which they are intended. These lubricants must have the characteristics required to meet the needs of textile machinery, such as those shown on the center spread.

Due to the specialized requirements of textile machinery it is not possible to provide a universal lubricant to meet all requirements. For example, some machinery parts, like textile spindles, require relatively low viscosity lubricants to give low power consumption and to lubricate in small clearance spaces. Other machinery parts, such as gears, may require high viscosity lubricants with special adhesive and load carrying ability (Extreme Pressure Properties).

The general types of textile lubricants are described below.

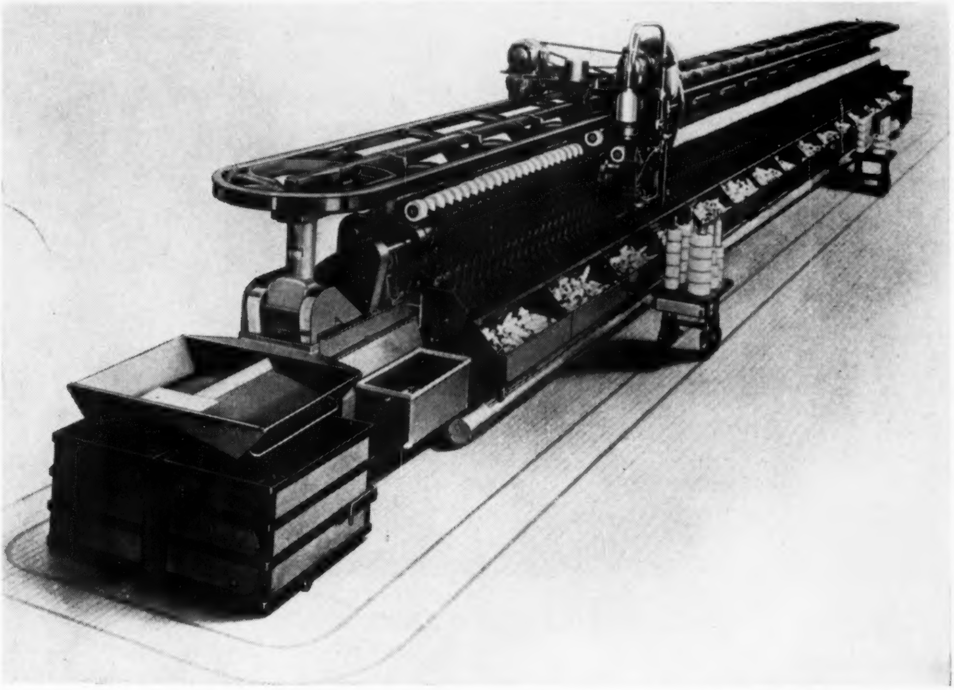
1. *Spindle Oils* are normally made of high-grade base stocks and may be fortified with additives. Such oils are required in various viscosities as determined by the needs of the particular spindles.

2. *General Purpose Oils* of a range of viscosities



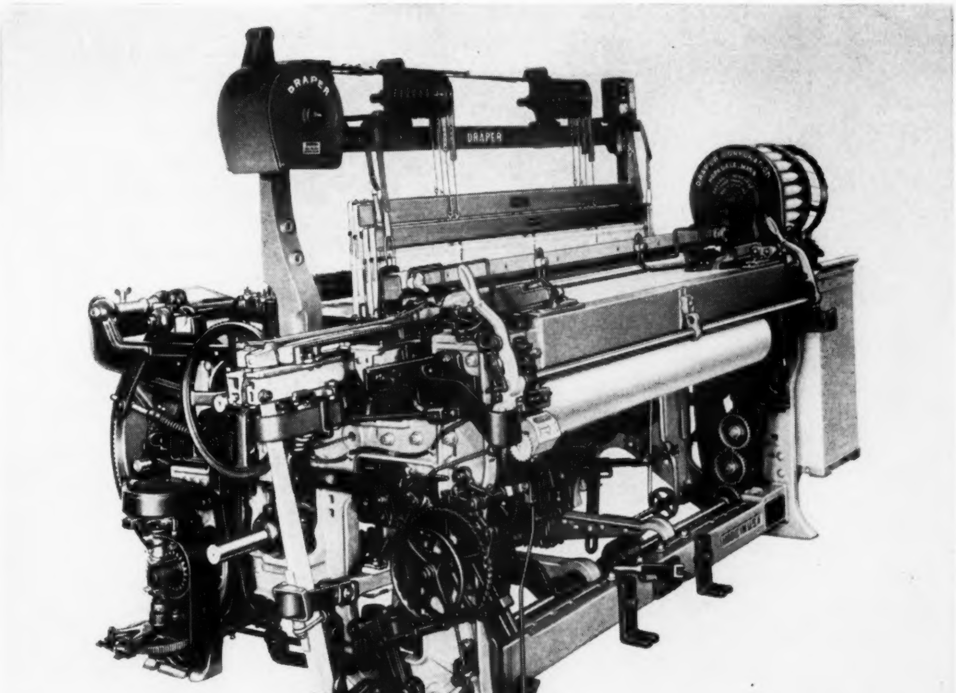
Courtesy of Whitin Machine Works and Bijur Lubricating Corporation

Figure 5 — Drawing machine equipped with central lubricator which operates at a speed of 250-300 feet per minute front roll delivery.



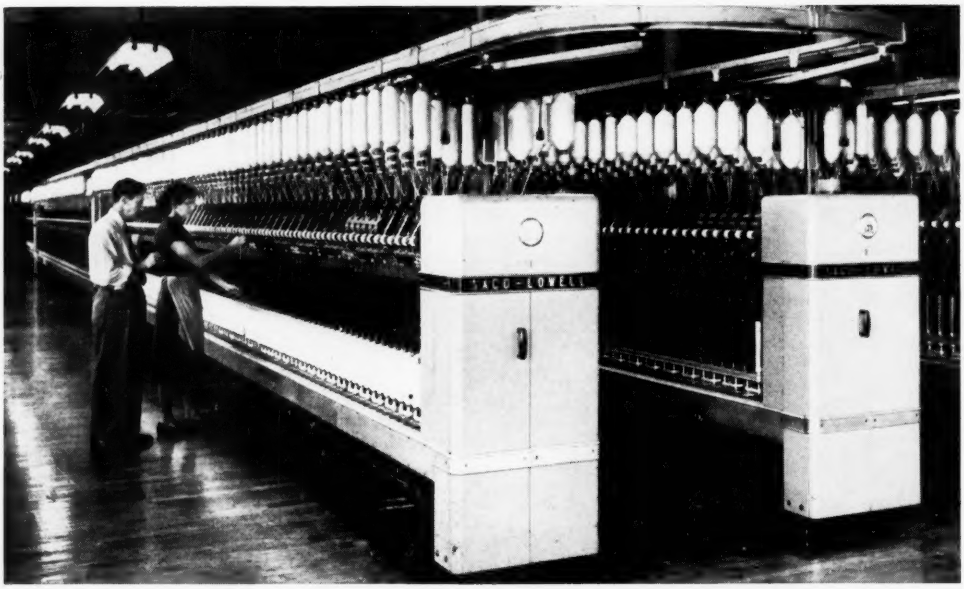
Courtesy of Barber-Coleman Company

Figure 6 — View of Automatic Spooler.



Courtesy of Draper Corporation

Figure 7 — High Speed Loom.



Courtesy of Saco-Lowell Shops

Figure 8 — View of spinning frames designed to handle larger packages.

are used for a variety of textile machinery and may have special characteristics to protect against rusting, minimize wear and be readily scourable from material. In certain cases, lubricants are designed to furnish special break-in characteristics. Also in many cases products are of turbine oil quality with respect to rust and oxidation resistance.

3. *Stainless Type Clear Needle Oils* are designed for all types of knitting machinery, particularly needles.

4. *Semi-Fluid Lubricants* are designed to minimize drippage and lubricant creeping when close proximity to yarn or fabric is present. Such type lubricants are normally designed to minimize product staining and to be readily washable.

5. A variety of *Greases* are used on textile machinery to meet the needs of high speed ball bearings, high temperature operations and special requirements such as looms. Multi-purpose greases also have been developed to meet a variety of needs and to make it possible to reduce the number of products to be stored and applied. In some cases solid type grease lubricants are applied in block form on plain bearings such as on finishing equipment. Greases to lubricate twister rings are special products designed for use with various types of travelers such as brass, steel or nylon.

6. A wide variety of lubricants are used to minimize wear and provide proper lubrication for gears and chains. These include straight mineral oils, universal type EP gear lubricants, lead soap lubricants and tacky type black gear lubricants. In some cases EP type greases are used both for their ability to minimize wear and for their adhesive characteristics.

7. A variety of processing oils contain petroleum components.

8. There are a number of miscellaneous requirements in the textile mills similar to those in other types of industrial plants, such as cylinder oils, cutting oils, compressor oils and transformer oils.

* * *

The proper selection and use of such lubricants in a particular mill is a job which deserves the closest cooperation between the machinery builders, mill personnel and the lubricant supplier to insure maximum operating benefits from the carefully engineered lubricants which are available.

LUBRICATION PROBLEMS AND REQUIREMENTS

General Problems

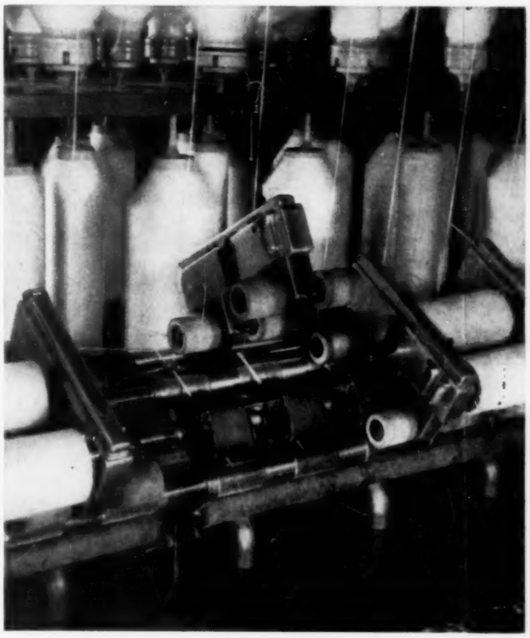
In the textile industry, contamination can be considered the major problem from the lubrication standpoint. Not only are many lubrication points, particularly on older equipment, relatively open, but the continual lint problem makes it difficult to maintain rubbing surfaces operating on lubricant free of lint or dirt. Collected lint also acts as a wick to draw lubricant from lubricating surfaces and makes more frequent re-lubrication necessary if harmful wear is to be avoided. In the older type machines the relatively large clearances make lubrication difficult and many lubrication points are equipped only with oil holes and are not designed to retain lubricant. On loom drives there can be

considerable back lash in the gears which can be aggravated by wear. Even when a so-called stainless or colorless oil is used, dirt can get in the lubricant and any subsequent drippings will discolor cloth.

Bearing seals are not used in many locations. Even where seals are provided, as on anti-friction bearings, pressure guns, if not carefully used, can rupture such seals by forcing too much grease into the bearing. When the bearing is operated with too much grease in the housing, overheating will result. Gears, even relatively high-speed ones, do not operate in a bath but are generally open, as in larger, slower-speed industrial types. This makes them difficult to lubricate and requires more frequent lubricant application than if gears could be in enclosed housings where the bottom gear could dip into an oil bath.

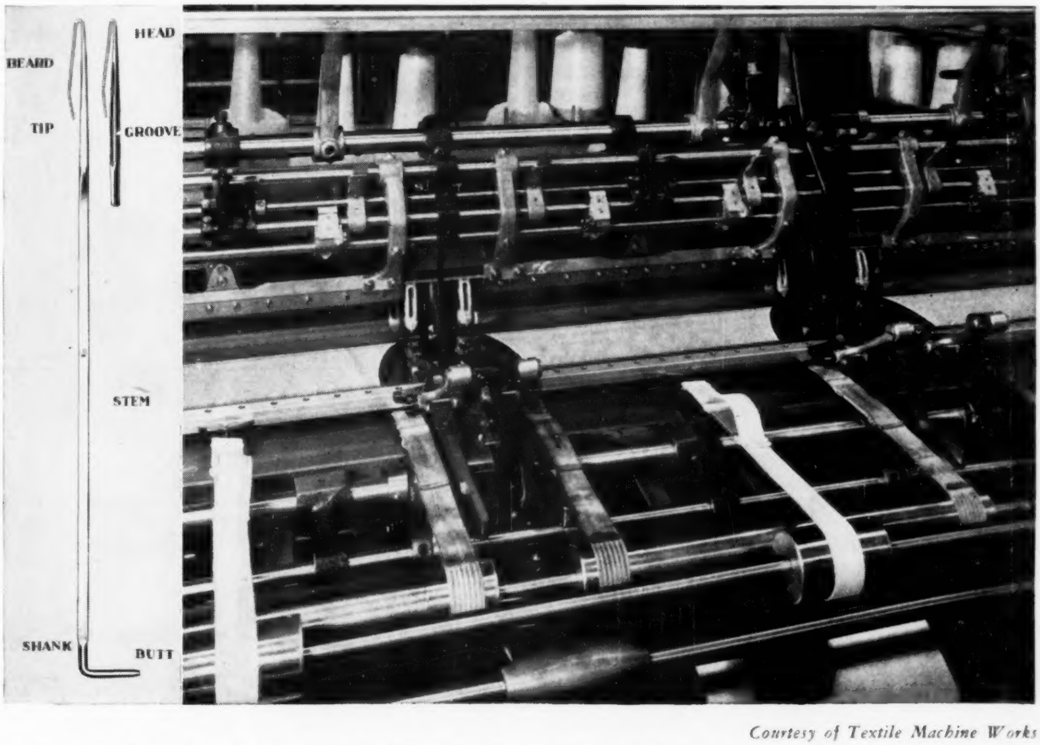
The humid atmosphere in many parts of textile mills not only encourages the formation of rust but also moisture can emulsify with oils and greases. High machinery speeds, both of the rotary and reciprocating type, and high temperatures are present in many cases. Exposure to chemicals is an additional problem for both machine parts and lubricants in the finishing portion of the mills.

The number of lubrication points is so great that a labor problem is created in insuring that the



Courtesy of Whitin Machine Works

Figure 9 — Close-up of top rolls and saddle section of spinning frame.



Courtesy of Textile Machine Works

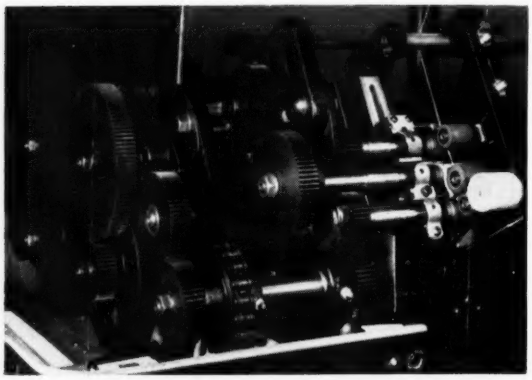
Figure 10 — (Left) Type of needle used in full-fashioned knitting machines. (Right) Close-up of full-fashioned knitting machine showing how numerous moving parts are close to or in touch with fabric.

SUMMARY OF IMPORTANT LUBRICANT CHARACTERIS

Lubricant Characteristics and Performance Factors Which Can Influence Lubricant Selection	Is This Ch Generally
Chemical Stability of Lubricants	
Resist oxidation	Y
Not form deposits	Y
Not thicken	Y
Stable in storage	Y
Stable in service	Y
Resist high temperatures	N
Non-gumming	Y
Non-sludging	Y
Not dry out	N
Turbine oil quality – inhibited from rust and oxidation standpoint.	N
Other Lubricant Characteristics	
Be non-corrosive and be free from acid forming tendencies	Y
Detergent Properties	N
Non-foaming	N
Non-atomizing	N
Ability to feed through wicks	N
Resistant to water	N
Anti-static properties	N
Resistant to formation of emulsions	N
Low volatility	Y
Non-separating	Y
Lubricant Characteristics Which Protect Machinery	
Protect against rust	Y
Anti-wear	Y
Load carrying ability (extreme pressure properties)	N
Highly refined lubricant	N
Protect bearings	Y
Anti-Brinnelling – Friction oxidation	N
Protect knitting needles	N
Act as seal	N
Lubricant Characteristics Which Protect Material in Process	
Clear or light color	N
Non-staining	N
Easily washable from material	N
Non-leaking	N
Non-dripping	N
Have break-in qualities	N
Low and even friction	Ye
Odor free	Ye
Lubricant Characteristics Which Maintain High Quality of Finished Material	
Oiliness to reduce vibration flaws	Ye
Reduce stick-slip	No
Permit even dyeing	No
Smooth, even, wear-free operation	Ye
Lubricant Characteristics Which Reduce Labor	
Adhesiveness	No
Tackiness	No
Ease of application	Ye
Feed from oil can readily	No
Stick to rubbing surfaces	Ye
Ability to feed through central lubrication systems	No
Permit maximum time between re-lubrication	Ye
Lubricant Characteristics Which Reduce Other Costs	
Low friction	Ye
Low lubricant consumption	Ye
Long lubricant life	Ye
Low power requirement	Ye
Reduction of wear which reduces down time for maintenance	Ye

CTERISTICS REQUIRED BY TEXTILE MILL MACHINERY

This Characteristic Generally Required?	Examples of Textile Equipment Lubrication Points Which Have Special Need for Lubricants with Such Characteristics
Yes	Spindle Bearings, twister rings, ball and roller bearings.
Yes	Comb boxes of cards, spindle bearings, ball and roller bearings.
Yes	Spindle bearings.
Yes	Ball and roller bearings, particularly pre-lubricated type.
Yes	All equipment.
No	Bearings of steam heated drums and finishing equipment.
Yes	Top rolls of spinning frames.
Yes	Comb boxes of cards, spindle bearings, ball and roller bearings.
No	All grease lubricated points.
No	Needle bearings in rolls of spinning frames.
Yes	Ball and roller bearings.
No	Spindle bearings.
No	Spindle bearings.
No	Spindle bearings.
No	Some types of saddles on spinning frames.
No	Lubrication points on finishing equipment exposed to water and solutions.
No	Spinning frames.
No	Lubrication points on finishing equipment exposed to water and solutions.
Yes	Spindle bearings.
Yes	Ball and roller bearings.
Yes	Spindle bearings, weaving equipment, knitting equipment during shutdown, reciprocating plain bearings of full-fashioned hosiery machines, ball and roller bearings.
Yes	Gears, pick balls and harness and pick cams of looms (particularly high speed) twister rings, saddles of spinning frames.
No	Loom cams, twister rings.
No	Spindle bearings, porous bearings of all types.
Yes	Cylinder bearings of cards, ball and roller bearings.
No	Some winding equipment, loom reciprocating bearings.
No	All types of needles.
No	Ball and roller bearings.
No	Spindle bearings, rolls on spinning frames, top loom lubrication points.
No	Spinning frames, looms, tenter frames.
No	Spinning frames, looms, tenter frames.
No	Ball and roller bearings particularly on finishing equipment.
No	Spinning frames, dobby heads on looms, and jacquard looms.
No	Saddles on spinning frames, spindle bearings, bottom draft rolls.
Yes	Spindle bearings.
Yes	All.
Yes	Spindle bearings, top rolls and saddles of spinning frames.
No	Lift rods on spinning frames.
No	All equipment where lubricant may come into contact with material.
Yes	All equipment.
No	Rolls and saddles of spinning frames, all parts of looms.
No	Loom gears and cams, rolls and saddles of spinning frames.
Yes	Looms – all parts, particularly pick and harness cams.
No	All equipment, particularly spinning frames and looms.
Yes	Top rolls and saddles, loom pick and harness cams.
No	All central lubrication systems.
Yes	All equipment.
Yes	Spindle bearings.
Yes	All equipment.
Yes	All equipment.
Yes	Spindle bearings.
Yes	All equipment.



Courtesy of Saco-Lowell Shops
Figure 11 — Gears in spinning frame.

proper amount, not too large or too small, is applied at a proper interval which varies for the various points. Despite such difficulty, positive and controlled lubrication is necessary to protect the machinery. For points which are lubricated by wick feeds, the wicking material can be blocked either by the use of the wrong lubricant or if proper maintenance practices are not followed. In this connection some lubricants can separate into soap and oil phases and are not considered suitable for wick feed lubrication.

Special Lubricant Requirements

Basically, textile machinery has the following types of points which must be lubricated: plain bearings (both metal and other types such as plastic), ball and roller bearings, sleeves and channel guides, slide cams, gears, chains, spindles, rings and travelers. These various types of lubrication points are used in a variety of different types of machinery. In one piece of equipment, depending on the design and operation, there may be specialized requirement for a lubricant, while in another, the same type of lubrication point will not have any critical lubrication requirement whatsoever. Differences in speed, load, temperature, materials of the rubbing surfaces, reservoir size, and adequacy of seals, can all account for such different lubrication requirements even with the same kind of mechanism.

As mentioned previously, the center spread shows the types of special lubricant characteristics which are desirable in certain textile machinery lubrication points. This table is by no means complete, but is given only as an example of the complexity of the needs of textile equipment. Examples of significant requirements are discussed in following sections of this article.

Spinning Frames

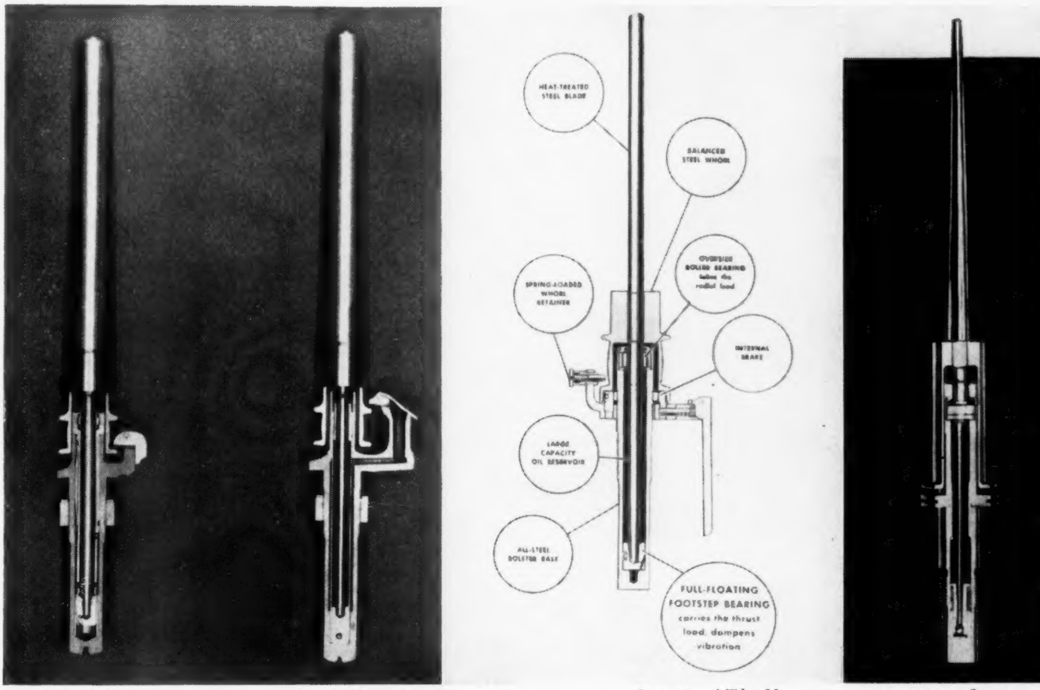
Saddles on the top rolls of spinning frames, when of a plain bearing type, require anti-wear properties in the lubricant, particularly when heavier loads are applied for long draft spinning. Additionally, it is desirable that such products not creep or drip onto the material, and semi-fluid type lubricants are often used to obtain such properties. Where wicks are used in the saddles, the lubricant must not separate into soap and oil phases, as such action can plug the wick and prevent lubricant flow to bearing area. Lift rods on spinning frames operate best with lubricants having special oiliness characteristics to eliminate the stick-slip action which might otherwise occur. Travelers move at mile a minute speeds and both they and the spinning rings upon which they slide, whether grease or oil lubricated, must be protected against wear and welding.

Spindles

Through the years spindles have been an important part of textile machinery. In recent years developments have been made to increase the package size so as to reduce labor and down time and to increase the speed to increase production rate. Spindle speeds of 10 thousand rpm are now general for cotton and speeds up to 12 to 16 thousand rpm are used for other fibres such as rayon.

An important spindle development also has been the use of ball and roller bearings which not only reduce power consumption but also lengthen periods between re-lubrication and reduce amount of lubrication required. When it is considered that approximately 50% of the power required in the spinning frame is accounted for in the spindle bearings, it can be seen that any reduction in friction at this point can result in relatively large savings when the thousands of spindles per mill are considered. Actually, as package size and spindle speeds have been increased, increased friction would be expected to result, although the development of the anti-

Courtesy of Universal Winding Company
Figure 12 — Uptwister.



A *Courtesy of Whitin Machine Works* B *Courtesy of The Marquette Metal Products Company* C *Courtesy of Universal Winding Company*

Figure 13

A — Cross-section of anti-friction and porous bearing type spindles.

B — Twister spindle.

C — Spindle used on uptwister which has flexible lower blade and which operates at speeds to 16,000 rpm.

friction type bearings has counteracted such effects.

In the conventional type plain bearing spindle the addition of oil is required from time to time to replace that lost through normal use. For anti-friction type bearing spindles, application of the lubricant need be less frequent. Although the majority of spindles are oil lubricated, an appreciable number of grease lubricated anti-friction bearing spindles are in use.

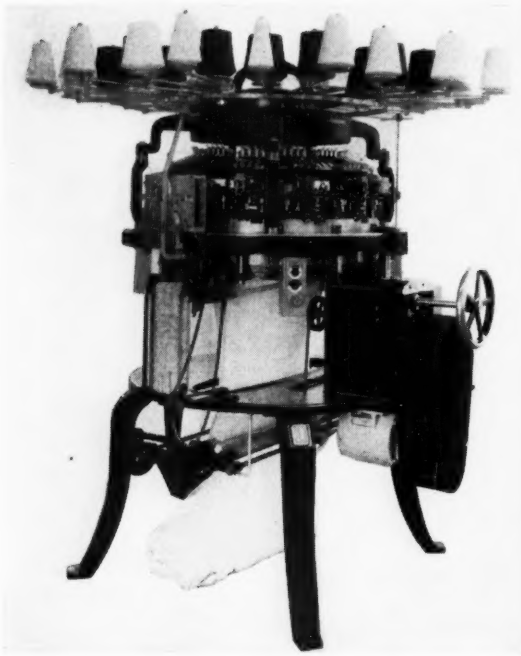
Actually, requirements for spindle lubricants are quite exacting to avoid increased friction, excessive spindle wear, excessive oil consumption and the eventual necessity of thorough cleaning. In the case of oil, for example, exceptionally good resistance to oxidation is needed both in the plain bearing and anti-friction bearing types. Such resistance to oxidation and thickening insures that no sludge is formed and that oil does not thicken and add to the power consumption of the textile mill.

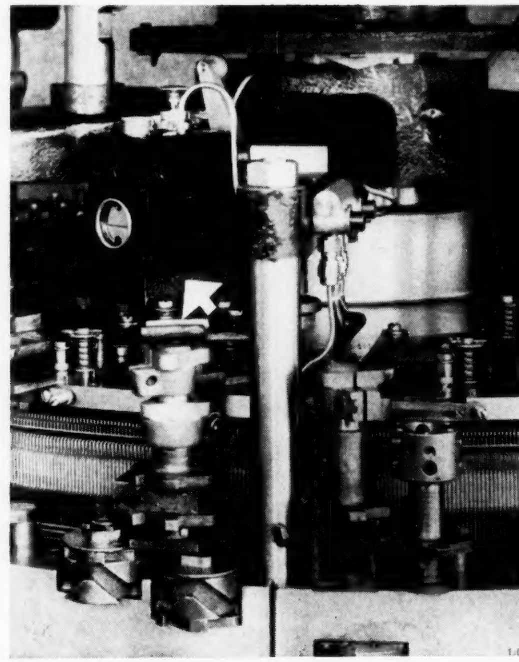
Besides the major requirement that a spindle oil resist oxidation, it is also important that it protect against rusting since in many cases moisture can and does get into the spindle bolsters and, unless an oil will protect against rusting, excessive wear and damage to parts can result.

The major requirement, of course, for all spindle oils is that they lubricate satisfactorily without permitting excessive wear and that they also serve as a shock absorber to dampen vibration. High grade spindle oils which are carefully refined have these characteristics and also are often fortified with additives. Types of additives most commonly used in high grade spindle oils include rust and oxidation inhibitors and additives to impart detergent and dispersive characteristics. In this connection, oils containing detergent and dispersive characteristics have even demonstrated an ability to clean spindles when sludge and deposits have previously been formed through the use of inferior quality spindle oils.

Also spindle oils should have a relatively high flash point, compared with the viscosity of the oil, and they should be light in color to eliminate any staining or discoloration in case they inadvertently come in contact with the material in process. Furthermore, spindle oils should not atomize, foam or evaporate since all three of such conditions can lead to higher oil consumption which increases costs of lubricant and manpower required to apply it.

Normally a spindle oil properly selected for the type of unit in which it is designed to operate will show a minimum temperature rise of 10 to 15





Courtesy of Jacquard Knitting Machine Co. and Bijur Lubricating Corp.

Figure 14 — (Left) High speed circular knitting machine. (Right) Close-up of central lubricator on this same knitting machine.

degrees above the ambient temperature. Any excessive rise in temperature is an indication of difficulty which could be caused by lack of lubricant.

With the newer type spindles, the desire of mill managements for lower costs of operation and less man power for lubricant application is being achieved and greater use of the improved type spindles can be anticipated.

Looms

Gears in loom power drives are subjected to shock loading and operate best on lubricants which are adhesive and can protect adequately against wear. Pick cams and harness cams on looms are also subject to shock loads and require lubricants having characteristics similar to the power drive gears. High speed looms have particular requirements for such EP (load carrying) type of lubricants. It is of interest in this connection that on loom gears there are over 50,000,000 load reversals a year, each one accompanied by a shock load.

Finishing Machinery

Special high temperature greases or oils are required for the bearings on steam drums of the finishing machinery and on slasher cylinders. Tenter frames which pass through high temperature ovens require lubricants which will not only operate at high temperatures but also which will not drip and stain cloth. This non-staining feature is particularly important in the finishing and dyeing department, where lubricants must resist emulsifying which might otherwise permit them to contaminate liquid solutions and spoil cloth.

Knitting Machinery Requirements

Knitting needles constitute an example of the precision parts typical of those used in knitting machinery. Such parts are very subject to wear and their close clearances increase the lubrication problem. Unless needles and other parts are protected against wear, management is faced with difficulties in striving for higher production rates, higher quality of output and less cost per unit produced.

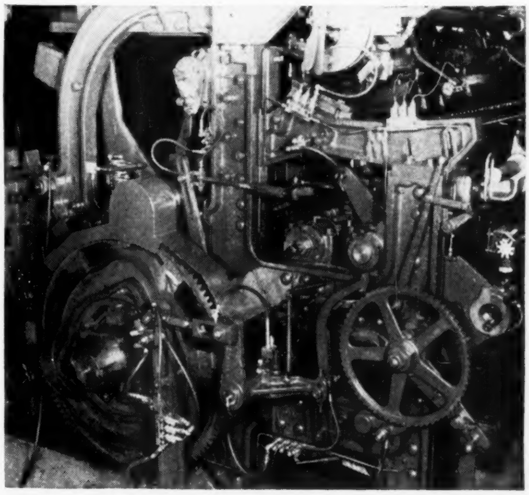
Wear and other conditions such as rusting and lubricant gumming can cause uneven movement, and needle and other part breakage, and may occur unless proper lubricants are used and suitable precautions taken. These conditions can lead to increased power costs, increased downtime, added cost of repairs, and spoilage of material through ragged operation and staining of fabric. It is not surprising that mill managements are alert to ward off such difficulties and glad to apply the relatively small effort required to provide an adequate lubrication program.

The possibility of rusting with such machinery is perhaps the most prevalent problem. Not only are high humidities normally present but some yarns are passed through water solutions of various types for conditioning prior to knitting. A particular problem is presented to operators of knitting mills by shut-down periods over weekends which increase the possibilities of rusting. Fortunately,

suitable lubricants have been developed and are available to minimize this difficulty. Not only are stainless type oils, normally having a viscosity of approximately 100 seconds SSU @ 100°F., available with anti-rusting features for needles, sinkers and other points in close proximity to the yarn and fabric, but other lubricants having similar protective characteristics are available in higher viscosity grades for other parts of the machines. In this connection, for example, some reciprocating plain bearings on full-fashioned knitting machines are very susceptible to rusting. Unless an oil with special protective features is used, such rust can be transferred to the fabric with resultant spoilage. It is of interest, also, that a lubricant of this type, when used periodically on the hand wheels of full-fashioned knitting machines, eliminates rusting which can be transferred to finished work by the operator's hands.

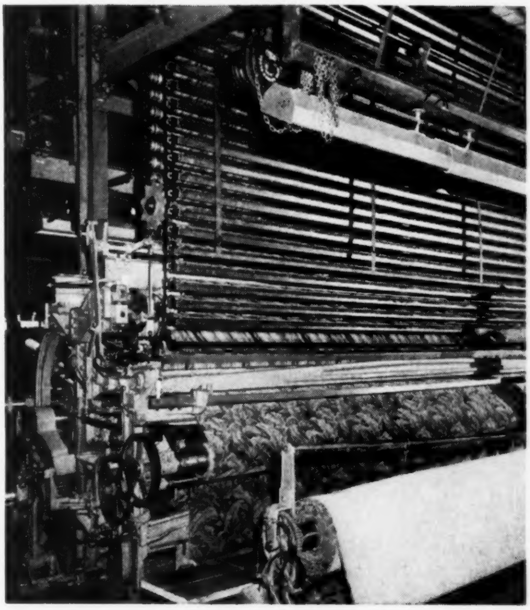
Lubrication of the high precision, close tolerance parts of knitting machinery requires that the lubricant have the ability to operate in close clearances without gumming, oxidizing or forming disagreeable odors. Oxidation resistance is an important characteristic in view of the large surfaces which are exposed to the air which increases the possibility of oxidation troubles. The lubricant also must have the ability to wet the metal to provide full and continuous lubrication and stay in place for the longest possible periods before the next scheduled lubricant application.

In view of the close proximity of the working parts of knitting machines to the yarn and fabric, any surplus lubricant applied may stain the cloth and may cause spoilage unless it can be readily scoured from the fabric in a later finishing operation. The



Courtesy of Crompton & Knowles Loom Works and Lincoln Engineering Company

Figure 15 — View taken during construction of central lubrication piping on a loom.



Courtesy of Crompton & Knowles Loom Works

Figure 16 — Carpet loom equipped with central lubricator supplying approximately 300 points.

use of a high grade compounded stainless knitting oil will help eliminate the problem of staining. The practical elimination of spotting and staining also requires that the least possible amount of oil be applied which will adequately lubricate the machinery. When lubrication is intermittent, as in any hand method of application, such as by oil can, brush or atomizer, some surplus lubricant may be applied. It is important in any hand oiling that appropriate re-lubrication periods are selected and strictly followed, based upon recommendations of equipment manufacturers. Such procedure will ensure the best compromise between the use of too much and too little lubricant.

One method of reducing the application of excess lubricant is by the use of central lubricators as will be described in more detail in the following section. An example is shown in Figure 14 on a circular type knitting machine. Additional advantages cited for such type systems applied to knitting machines are less down-time for lubrication, less man power needed for applying lubricant and insurance against excessive wear from lack of lubrication.

CENTRAL LUBRICATION

A significant development which has gained increasing acceptance in recent years is the use of centralized lubricators on textile mill machinery. By this means it is possible to have the lubricant for a large number of machinery points applied in the desired amount by means of piping from a central

CHECK LIST FOR MANAGERS ON THE LUBRICATION OF TEXTILE MACHINERY

The following are major points to check in planning, carrying out and supervising the lubrication program of a textile mill.

1. Have a written lubrication schedule.
2. Assign responsibility for lubrication and make certain oilers are properly trained and supervised.
3. Make certain that suitable quality lubricants are used, particularly on critical applications.
4. Use as few lubricants as possible to simplify handling.
5. Consider the possibility of installing automatic oiling devices.
6. Provide modern lubricating equipment including air operated grease guns where necessary.
7. Provide the best type of oil cans with pistol grip to give proper lubricant amount.
8. Have lubricant containers stored in protected area, preferably indoors, and maintained in clean condition.
9. Provide proper storage for lubricating equipment and oil cans adjacent to places where oiling will be accomplished.
10. Make sure oil lead-in pipes to bearings are checked periodically and cleaned where necessary.

applicator. The lubricant is either filled into a central reservoir or it can be drawn directly from the original supply drum and metered to the individual points.

A centralized system consists of three main components:

1. The lubricator can be a combination pump, filter and reservoir which can be located on the machine to be lubricated. By means of the pump or hand operated plunger, the oil is filtered and forced under pressure into the distribution system of pipes at pre-selected periods and in the desired amounts.

2. The distribution system consists of a system of tubings to connect all bearings or lubrication points to the central lubricator. In some cases where there is vibration, a flexible line is used. In other cases tubing is looped to minimize vibration difficulties.

3. Each individual line in the distribution system is provided with a metering device which controls the flow of lubricant to the point to be lubricated. It is possible to meter different amounts of oil to different lubricant points, depending on their needs, by the use of different size metering units. Normally check valves are provided and are closed except during the lubrication period so that no leakage occurs and the lines normally remain full of lubricant.

The main advantages of centralized systems are considered to be:

1. less down-time for lubrication, as lubrication takes place while equipment is operating.

2. less man power required for lubrication.

3. a controlled amount of lubricant is furnished.

4. less material spoilage occurs due to less excess lubricant.

5. cleaner lubrication results since lines remain clean due to filters and any leakage tends to flush dirt out and away from rubbing parts.

6. less consumption of lubricant.

Centralized lubrication systems have been applied to all types of textile machinery including that for blending, picking, carding, drawing, combing, roving, spinning, twisting, spooling, winding, weaving, knitting and sewing. In many cases the number of lubrication points per centralized system is well over 100. Centralized lubricators are now standard or optional equipment on much new machinery and may also be installed on machines already in use.

The method of application through such a central system may be either manual or automatic. If the system is manual it is necessary for an operator to make a "one shot" application at scheduled periods. In automatic application, the centralized system is actuated by direct connection with the machine to be lubricated so that a lubricant application is made at a pre-selected number of revolutions or cyclic movements of the machine. On some systems an alarm or signal indicates when the lubricant level reservoir drops to a point where it needs replenishing.

It is of interest that centralized lubricators can be used to apply both oil and grease type lubricants. The grease selected for use in such lubricators must be readily pumpable at the conditions and pressures of operation and must not separate into a soap and oil phase in the distribution lines.

RECOMMENDED LUBRICATION PROCEDURES

Each individual piece of textile machinery needs special consideration in order to select the best lubricating practices. There are, however, certain general considerations for a lubricating program which are desirable.

HINTS TO TEXTILE MILL LUBRICATING PERSONNEL

1. Follow written lubrication schedule strictly in oiling of individual lubrication points.
2. Wipe grease fittings clean before applying lubricant.
3. Make sure oil holes are cleaned out if necessary before applying oil.
4. Oil only after picking on spinning frames.
5. Oil only after blow down on all types of equipment.
6. Use only correct amount of lubricant. Any excess does no good, collects lint and drips on floor where it must be wiped up.
7. When lubricating ball bearings with seals make certain excess grease is not supplied. Such excess can rupture seals and cause bearing to run hot through excessive churning of the lubricant.

For example, in the planning and the carrying out of the lubrication program which will give maximum benefits to a textile mill, a number of important steps should be considered, as follows:

1. Review machinery parts to be lubricated.
2. Select lubricants.
3. Decide on frequency of application based on past experience and best advice of machinery builder.
4. Consider method and equipment for lubricant application.
5. Review lubricant storage and handling procedures.
6. Pin point responsibility for training and supervising personnel who will do the lubricating.

A careful study of equipment needs, based upon plant experience and advice from the equipment manufacturer and lubricant supplier, should be used to develop a written lubrication schedule for the direction of lubricating personnel. Such a schedule is valuable in training new personnel and in serving as a guide in studying possible improvements to the procedures. It is desirable that lubrication schedules be planned with some consideration of the cleaning schedules to simplify work where possible. For example, it is desirable that any picking of spinning frames to remove lint and any blowing down of equipment with air be done *before and not after* the lubrication is accomplished. This is to prevent splattering of fresh lubricant which may get on and discolor yarn or materials.

It is entirely possible that the mere planning of a lubrication schedule will itself develop improvements in the operation of a plant which will either save manpower or other costs, or insure improved machinery performance. It is of interest that it is not an objective of planning a lubrication schedule to increase the frequency of re-lubrication except where necessary. In many cases it may be found that less frequent lubrication or the application of less lubricant will be entirely suitable when proper products are used. The carrying out of a suitable lubrication program will also guard against lack of lubrication which can result in hot bearings which

Courtesy of Lincoln Engineering Company

Figure 17 — Close-up of central lubricator installation.

can be responsible for fires in textile mills.

In planning the program it is well to consider the desirability of selecting lubrication equipment such as oil cans and grease-dispensing equipment which are most efficient from the standpoint of manpower required and ease of application. Oil cans are scientific instruments these days and types can be obtained, for example, which can be adjusted not only to deliver the required amount of lubricant but also to guard against drippage which can add to the dirt and fire hazard in textile mills. In some cases anti-friction bearings are lubricated by the use of hollow injection needles, which can be screwed to oil can spouts, through which lubricant is fed to the bearings. Obviously it is important that any selection of oiling equipment give consideration to the specific lubricant which is intended for use. For example, an oil can selected to deliver the correct amount of a certain type of oil may give either too much or too little application if a higher or lower viscosity oil is subsequently used. It is also important to select the very best equipment which can reduce the manpower required for such items as greasing. In many cases it may be found desirable to use larger grease-dispensing equipment than a hand gun to reduce labor required in refilling. In many cases the use of automatic type greasing equipment may also reduce the possibility of contamination which is present with frequent refilling of a hand gun.

It is desirable to review the lubrication points to determine whether oil cups, bottle type oilers, wick feed oil cups or grease pressure fittings should be installed to improve operation by reducing manpower required for lubrication and minimizing the possibility of contamination. One very definite advantage of bottle oilers and wick feed cups, for example, is the fact that lubricant is fed over a long period of time at a more even rate than is possible with manual application. There is a fertile field in the consideration of lubricant applications on textile machinery for ingenuity and for the use of methods which have been found useful elsewhere. Representatives of the lubricant supplier are usually in a position to advise on these points.

When re-oiling porous type bearings it is important that recommended type oils be used. Normally such bearings are re-oiled, provided they are in good condition, by immersing them for about 15 minutes in the proper grade of oil heated to about 140°F. Normally, viscosities ranging from 300 to 500 SSU are used except in porous bearings for spindles which make use of a much lower viscosity oil.

Due to the contamination feature which may occur, particular care of lubricants before use is advisable. Wherever possible they should be stored in the best central location where some provision can be made to maintain the area as clean as possible and the responsibility assigned for insuring proper storage. Drums should not be stored outside bung end up or water may enter, caused by rain and normal breathing.

In many cases fabrics may be stained in a mill and there may be no indication of where the contamination is occuring. It has been found possible in many cases to trace down the source of staining where lubricant is involved by making use of a so-called black light. Lubricants when exposed to such light will give various degrees of fluorescence. It is possible by this means to determine the pattern of fluorescence of the new lubricants used in the mill and then by exposing the stained material to the light to compare its fluorescence with that of new lubricants. In numerous cases such means has pin pointed the source of staining and indicated the appropriate action needed to eliminate it.

And *last but not least* the use of high quality lubricants will insure maximum benefits, particularly on critical textile machinery applications. The use of inferior lubricants can be compared to the use of cheap paint on a house. The labor of applying both high and low quality paints one time is the same, but with inferior paints it is necessary to paint more frequently. Inferior lubricants are relatively even more unsuitable than cheap house paints for even with more frequent lubricant applications, the machinery will not be as well protected as they would be with high quality lubricants.

CONCLUSION

Textile mill operators can reap benefits from a good lubrication program if they are willing to participate fully in planning and carrying it out, and arrange to use the high quality lubricants specially developed for their needs. The carrying out of such program can best be promoted by giving recognition to the importance of such program and by training, supporting and supervising the men responsible for carrying it out. Such program will avoid costly repairs, which require the use of new parts and skilled mechanics' time, and costly down time which reduces production. An important result of such program will be the maintenance of a high standard of product quality at the lowest unit cost. Compared to the potential savings which can accrue from such proper lubrication program, the cost of the actual lubricants becomes a relatively minor item. The cost difference between an inferior lubricant and a high quality lubricant is a still smaller increment compared to the possible benefits which the use of high quality lubricants will provide.

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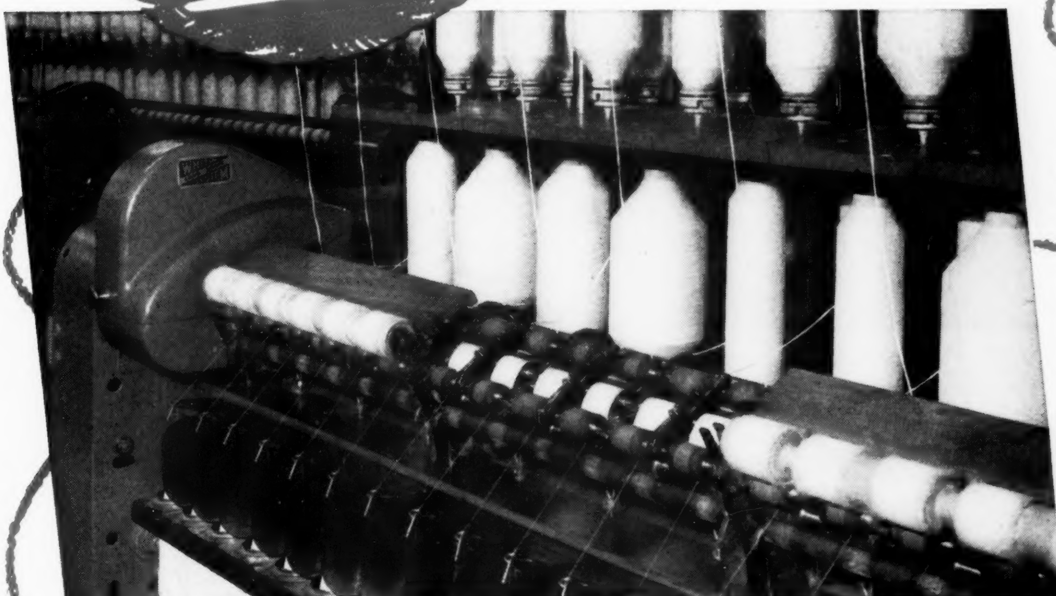

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